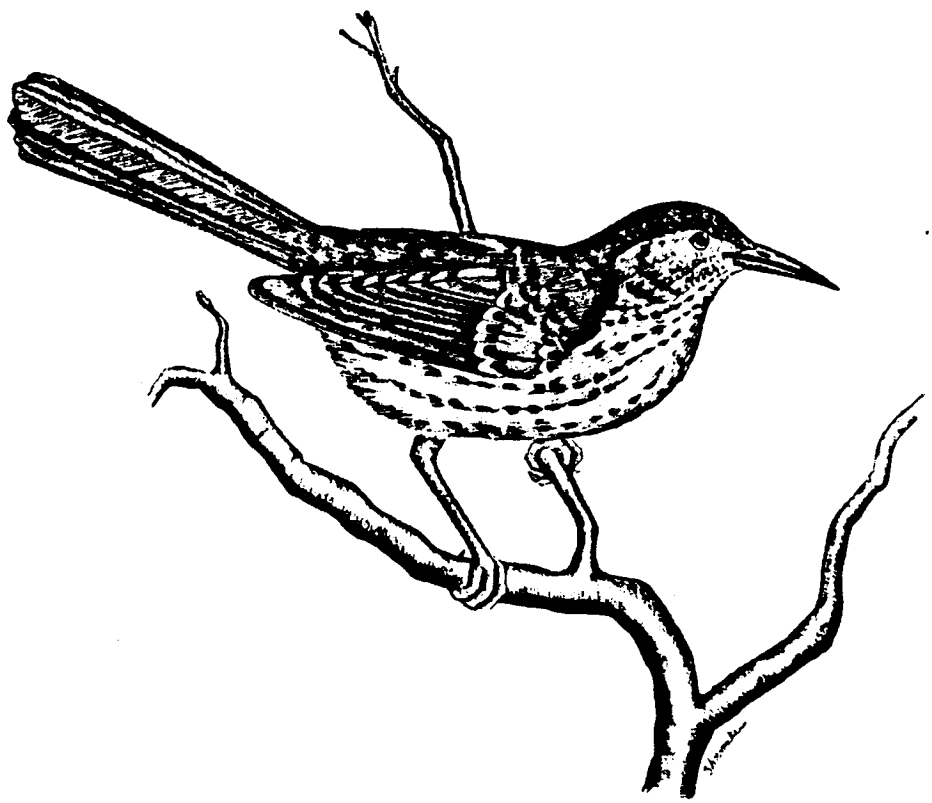
BIOLOGICAL REPORT 82(10.118)
APRIL 1986

HABITAT SUITABILITY INDEX MODELS: BROWN THRASHER



Fish and Wildlife Service

U.S. Department of the Interior

MODEL EVALUATION FORM

Habitat models are designed for a wide variety of planning applications where habitat information is an important consideration in the decision process. However, it is impossible to develop a model that performs equally well in all situations. Assistance from users and researchers is an important part of the model improvement process. Each model is published individually to facilitate updating and reprinting as new information becomes available. User feedback on model performance will assist in improving habitat models for future applications. Please complete this form following application or review of the model. Feel free to include additional information that may be of use to either a model developer or model user. We also would appreciate information on model testing, modification, and application, as well as copies of modified models or test results. Please return this form to:

Habitat Evaluation Procedures Group
U.S. Fish and Wildlife Service
2627 Redwing Road, Creekside One
Fort Collins, CO 80526-2899

Thank you for your assistance.

Species _____ Geographic Location _____

Habitat or Cover Type(s) _____

Type of Application: Impact Analysis ____ Management Action Analysis ____
Baseline ____ Other _____

Variables Measured or Evaluated _____
_____
_____
_____

Was the species information useful and accurate? Yes ____ No ____

If not, what corrections or improvements are needed?_____
_____
_____
_____

Were the variables and curves clearly defined and useful? Yes ____ No ____

If not, how were or could they be improved? _____

_____

_____

_____

Were the techniques suggested for collection of field data:

Appropriate? Yes ____ No ____

Clearly defined? Yes ____ No ____

Easily applied? Yes ____ No ____

If not, what other data collection techniques are needed? _____

_____

_____

_____

Were the model equations logical? Yes ____ No ____

Appropriate? Yes ____ No ____

How were or could they be improved? _____

_____

_____

_____

Other suggestions for modification or improvement (attach curves, equations, graphs, or other appropriate information) _____

_____

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_____

Additional references or information that should be included in the model:

_____

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Model Evaluator or Reviewer _____ Date _____

Agency _____

Address _____

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_____

Telephone Number Comm: _____ FTS _____

Biological Report 82(10.118)
April 1986

HABITAT SUITABILITY INDEX MODELS: BROWN THRASHER

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PREFACE

This document is part of the Habitat Suitability Index (HSI) Model Series [Biological Report 82(10)], which provides habitat information useful for impact assessment and habitat management. Several types of habitat information are provided. The Habitat Use Information section is largely constrained to those data that can be used to derive quantitative relationships between key environmental variables and habitat suitability. This information provides the foundation for the HSI model and may be useful in the development of other models more appropriate to specific assessment or evaluation needs.

The HSI Model section documents the habitat model and includes information pertinent to its application. The model synthesizes the habitat use information into a framework appropriate for field application and is scaled to produce an index value between 0.0 (unsuitable habitat) and 1.0 (optimum habitat). The HSI Model section includes information about the geographic range and seasonal application of the model, its current verification status, and a list of the model variables with recommended measurement techniques for each variable.

The model is a formalized synthesis of biological and habitat information published in the scientific literature and may include unpublished information reflecting the opinions of identified experts. Habitat information about wildlife species frequently is represented by scattered data sets collected during different seasons and years and from different sites throughout the range of a species. The model presents this broad data base in a formal, logical, and simplified manner. The assumptions necessary for organizing and synthesizing the species-habitat information into the model are discussed. The model should be regarded as a hypothesis of species-habitat relationships and not as a statement of proven cause and effect relationships. The model may have merit in planning wildlife habitat research studies about a species, as well as in providing an estimate of the relative suitability of habitat for that species. User feedback concerning model improvements and other suggestions that may increase the utility and effectiveness of this habitat-based approach to fish and wildlife planning are encouraged. Please send suggestions to:

Habitat Evaluation Procedures Group
Western Energy and Land Use Team
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2627 Redwing Road
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Dr. Dean F. Stauffer, Department of Fisheries and Wildife Sciences, Virginia Polytechnic Institute and State University, Blacksburg, and Gregory A. Hiemenz, Zoology Department, North Dakota State University, Fargo, reviewed earlier drafts of this model. Their comments and suggestions are greatly appreciated. The cover of this document was illustrated by Jennifer Shoemaker. Word processing was provided by Dora Ibarra, Elizabeth Barstow, and Patricia Gillis. Kay Lindgren assisted with literature searches.

Funding for the development of this model was provided by the Upper Missouri Region Office, U.S. Bureau of Reclamation, Billings, Montana.

BROWN THRASHER (Toxostoma rufum)

HABITAT USE INFORMATION

General

Brown thrashers (Toxostoma rufum) breed "...from southeastern Alberta, central Saskatchewan, southern Manitoba, southern Ontario, southwestern Quebec, Vermont, New Hampshire, southwestern Maine and New Brunswick south to east-central Texas (south to Nueces County), the Gulf coast and southern Florida (to the upper Keys), and west to western Montana, eastern Wyoming, eastern Colorado, northeastern New Mexico and western Kansas..." (American Ornithologists' Union 1983:571). They winter "...from eastern New Mexico, northern Texas, eastern Oklahoma, Arkansas, western Tennessee, central Kentucky, North Carolina and southern Maryland (casually north to southern Ontario, and the northern United States from Minnesota eastward) south to southeastern Texas, the Gulf coast and southern Florida." Brown thrashers occupy a variety of vegetation types from grassland to mature forests (Graber et al. 1970).

Food

Brown thrashers are omnivorous ground foragers (Graber et al. 1970; Cassel and Wiehe 1980; Fischer 1981a) that occasionally ascend shrubs and trees to feed on berries and fruit (Niemi and Pfannmuller 1979; Fischer 1981a). Invertebrates (Hymenoptera, Lepidoptera, Coleoptera, Hemiptera, Orthoptera, Arachnida, and Myriapoda) and plant seeds (e.g., Quercus spp. and Zea mays) are the principal foods on the breeding range during April through June; fruit and berries (e.g., Prunus spp., Rubus spp.) increase in the diet during July and August (Graber et al. 1970). When brown thrashers arrive on winter range in southern Texas in October, they feed on berries (57.9% by volume), but shift to a predominantly invertebrate diet (80.2% by volume in March) during winter (Fischer 1981a). Insects (Insecta) are preferred animal foods; spiders (Arachnida), gastropods (Gastropoda), and crustaceans (Crustacea) are minor components of the diet and are used less than availability; millipedes (Diplopoda) are avoided.

The characteristic mode of ground foraging by brown thrashers includes a combination of rapid bill sweeps through the litter and pecking and probing into the substrate (Fischer 1981a). Brown thrashers wintering in southern Texas foraged for 47% of the day (Fischer 1981b); activity patterns were cyclic, averaging 14 minutes of foraging followed by 15 minutes of loafing.

Water

Water requirements for brown thrashers are unknown.

Cover

Brown thrashers occupy a wide variety of cover types on their breeding range (Table 1), but highest densities occur in dense woody vegetation associated with shrub thickets, hedgerows, forest edges, or midsuccessional forests (Graber et al. 1970; James 1971; Shugart and James 1973; Temple et al. 1979; Stauffer and Best 1980; Faanes 1983). The most consistent habitat characteristic around brown thrasher song perches in Missouri was a litter depth of 1 to 2 cm (Kahl et al. 1985). Stems <2.5 cm dbh ranged from 350 to 2,450/ha, stems >2.5 cm dbh ranged from 24 to 2,100/ha, litter coverage ranged from 55% to 95%, and canopy height ranged from 4 to 18 m, all characteristics associated with forest edge or overgrown grassland-old fields. In a bottomland hardwood forest in Louisiana, brown thrashers were observed primarily at heights of 0.6 to 7.6 m, but were commonly observed at all other heights (Dickson and Noble 1978).

Early successional woody fields in Arkansas with highest densities of brown thrashers (61.8 males/100 ha) had 25% tree canopy cover, 519 trees (>7.6 cm dbh)/ha, and 11,243 understory stems (≤7.6 cm dbh and ≥1.4 m tall)/ha (Shugart and James 1973). Thrasher densities were lower (7.4 males/100 ha) in a clonal persimmon (Diospyros virginiana) plot with 17% tree canopy cover, 301 trees/ha, and 796 understory stems/ha. Two mature forests, with 74% and 64% tree canopy cover, 477 and 907 trees/ha, and 551 and 1,804 understory stems/ha, had no breeding thrashers.

Brown thrashers occupied hardwood draws, forested floodplains, and forested escarpments in North Dakota (Table 2), with highest breeding densities occurring in hardwood draws having high densities of young trees or shrubs and low percent canopy coverage (Faanes 1983). Within hardwood draws, brown thrasher territories (30 random plots) had fewer (t-test, $P < 0.05$) trees ($\bar{x}$ = 245/ha vs. $\bar{x}$ = 445/ha) and lower ($P < 0.05$) percent canopy cover ($\bar{x}$ = 19.5% vs. 32.7%) than areas outside territory boundaries (52 random plots) (G.A. Hiemenz, Zoology Department, North Dakota State University, Fargo; unpubl. data). Shrub densities ($\bar{x}$ = 14,285/ha vs. $\bar{x}$ = 12,823/ha) and percent ground cover ($\bar{x}$ = 65.9% vs. $\bar{x}$ = 61.5%) did not differ ($P > 0.05$) between areas within and outside thrasher territories. Tree (stems ≥5 cm dbh) densities averaged 391/ha (range 14 to 2,700/ha) and sapling (stems <5 cm dbh) densities averaged 1,370/ha (range 16 to 20,400/ha) at 115 brown thrasher locations in upland habitats adjacent to riparian areas in Iowa (D. F. Stauffer, Department of Fisheries and Wildlife Sciences, Virginia Polytechnic Institute and State University, Blacksburg; unpubl. data).

Highest densities of brown thrashers on winter range in southern Texas occurred in riparian woodland (Emlen 1972; Fischer 1981a). Brown thrashers did not use grass-forb prairie, scrub grassland, open brushland, and 2-layer brushland; they occurred at densities of 2.0 birds/100 ha in dense brushland, 14.9 birds/100 ha in oak woodland, and 30.3 birds/100 ha in riparian forest (Emlen 1972). Fischer (1981a) observed highest densities of wintering brown thrashers in riparian woodlands of mature hackberry (Celtis spp.)/anaqua (Ehretia anacua)/elm (Ulmus crassiflora) (780 birds/100 ha) and dense, young hackberry (840 birds/100 ha). Foraging sites of brown thrashers in riparian

Table 1. Densities of brown thrashers in various cover types on the breeding range (all values converted to males/100 ha).

Location	Cover type[a]	Males/100 ha	Reference
North Dakota	Green ash-elm draw	74.1	Hiemenz 1981
	Shrub draw	72.5	Hiemenz unpubl.[b]
	Green ash escarpment	22.2	Fleckenstein and Mack 1981
	Cottonwood floodplain	6.4	Fleckenstein and Mack 1981
Iowa	Scrub	17.5	Stauffer and Best 1980
	Upland woodland	17.5	Stauffer and Best 1980
	Wooded edge	12.5	Stauffer and Best 1980
	Savannah	7.5	Stauffer and Best 1980
	Floodplain woodland	6.7	Stauffer and Best 1980
	Herbaceous	1.7	Stauffer and Best 1980
Minnesota	Seedling/sapling aspen	7.5	Back 1979
Vermont	Sapling/pole aspen	15.0	Back 1979
Michigan	Coniferous/deciduous forest	5.0	Kendeigh 1948
Illinois	Hedgerows	233.5	Graber et al. 1970
	Thickets	139.6	Graber et al. 1970
	Second-growth forests	106.3	Graber et al. 1970
	Shrub/grass	45.0	Willson 1974
	Shrubby old-field	45.0	Willson 1974
	Late shrub/early forest	22.5	Willson 1974
	Parkland estates	22.2	Graber et al. 1970
	Orchards	14.8	Graber et al. 1970
	Swampy prairie	11.1	Graber et al. 1970
Arkansas	Woody field	61.8	Shugart and James 1973
	Burned field	14.8	Shugart and James 1973
	Clonal persimmon tree	7.4	Shugart and James 1973
Georgia	5 to 35-year loblolly/ shortleaf pine	<12.5	Meyers and Johnson 1978
Northeast	Seedling/sapling white, red, and jack pine forests	10.0 to 50.0	Capen 1979

[a]Scientific names of trees not mentioned in text: green ash (Fraxinus pennsylvanica); elm (Ulmus americana); aspen (Populus tremuloides, P. grandidentata); loblolly pine (Pinus taeda); shortleaf pine (P. echinata); white pine (P. strobus); red pine (P. resinosa); jack pine (P. banksiana).

[b]G. A. Hiemenz, Zoology Department, North Dakota State University, Fargo.

Table 2. Vegetation structure and breeding densities of brown trashers in hardwood habitats in North Dakota.

Type[a]	Area (ha)	Trees /ha[b]	Percent tree canopy coverage	Shrubs /ha	Males/100 ha maximum	Males/100 ha minimum	Years censused	Reference
1. Tree draw	5.4	405	39	--	74.1	37.0	1979-80	Hiemenz 1981
2. Shrub draw	8.2	134	7	7,807[c]	72.5	37.5	1981-83	Hiemenz unpubl.
3. Tree draw	4.7	562	34	--	63.8	21.3	1979-80	Hiemenz and Wallace 1981
4. Tree draw	9.4	323	39	6,021[c]	52.5	22.5	1981-83	Hiemenz unpubl.
5. Shrub draw	12.4	0	0	4,153[c]	47.5	47.5	1981-82	Hiemenz unpubl.
6. Shrub draw	10.6	66	9	4,096[c]	37.5	27.5	1981-82	Hiemenz unpubl.
7. Tree draw	8.4	537	37	7,611[c]	35.0	35.0	1982-83	Hiemenz unpubl.
8. Tree draw	15.0	492	30	34,687[c]	32.5	27.5	1981-83	Hiemenz unpubl.
9. Tree draw	14.2	262	61	28,416[d]	28.2	--	1982	Berkey 1983
10. Tree draw	14.9	759	50	16,714[c]	27.5	7.5	1981-83	Hiemenz unpubl.
11. Tree draw	16.1	983	78	13,156[e]	24.8	--	1980	Fleckenstein and Mack 1981
12. Forested escarpment	18.0	1,621	84	29,756[e]	22.2	--	1980	Fleckenstein and Mack 1981
13. Tree draw	5.6	2,350	88	40,952[e]	17.8	--	1980	Fleckenstein and Mack 1981

Table 2. (Concluded)

Type[a]	Area (ha)	Trees /ha[b]	Percent tree canopy coverage	Shrubs /ha	Males/100 ha maximum	Males/100 ha minimum	Years censused	Reference
14. Tree draw	13.6	1,433	49	208,080[e]	14.7	--	1980	Fleckenstein and Mack 1981
15. Forested floodplain	8.1	116	42	24,586[d]	12.3	--	1982	Berkey 1983
16. Forested floodplain	19.0	197	85	--	10.5	0.0	1979-80	Hopkins and Schwartz 1981
17. Tree draw	9.9	867	73	26,348[e]	10.1	--	1980	Fleckenstein and Mack 1981
18. Forested floodplain	15.7	1,136	72	17,507[e]	6.4	--	1980	Fleckenstein and Mack 1981

[a] Areas 2 and 14, 4 and 17, 8 and 12, and 10 and 11 overlap, but were sampled differently (G. A. Hiemenz, pers. comm.)

[b] Stems $\geq$7.6 cm dbh

[c] Stems $\geq$1.0 m tall and <7.6 cm dbh

[d] Stems $\geq$1.4 m tall and <7.6 cm dbh

[e] Stems <7.6 cm dbh

woodlands were characterized by litter depths of 0.5 to 6.5 cm ($\bar{x}$ = 2.6 cm for mature and 3.5 cm for young woodlands), 25% to 100% litter cover ($\bar{x}$ = 87.0% for mature and 87.5% for young woodlands), 100% overstory cover, and tree heights ranging from 1.0 to 16.0 m ($\bar{x}$ = 9.3 m for mature and 5.6 m for young woodlands) (Fischer 1979). Brown thrashers were territorial during winter and appeared to exclude long-billed thrashers (T. longirostre) from the invertebrate-rich riparian woodlands (Fischer 1981a).

Reproduction

Male brown thrashers are territorial (Graber et al. 1970) and both sexes share incubation and care of the young (Partin 1977; Heagy and Best 1983). Characteristics of breeding habitats were discussed in the Cover section. Brown thrashers nest in shrubs, trees (Graber et al. 1970; Partin 1977; Stauffer and Best 1980), and occasionally on the ground (Graber et al. 1970; Facemire 1978). Seventy-one percent of 314 nests located in Illinois were in shrubs, 18% in deciduous trees, and 11% in coniferous trees (Graber et al. 1970). In riparian habitats in Iowa, 77% of 31 brown thrasher nests were in shrubs, 19% in deciduous trees (including saplings), and 3% in coniferous trees (Stauffer and Best 1980). In south-central Michigan, Shalaway (1985) found four brown thrasher nests in shrub (woody vegetation 1.5 to 3.5 m tall) fencerows, three in wooded (woody vegetation >3.5 m tall) fencerows, and none in grass (grass and forbs) fencerows. Nesting success was higher in wooded (three of three fledged ≥1 young) than shrub fencerows (one of four fledged ≥1 young). Most thrasher nests in Illinois were found 0.6 to 1.8 m above ground (Graber et al. 1970). Nest heights ranged from 0.4 to 2.8 m ($\bar{x}$ = 1.3 m) in Kentucky, with nests built later in the breeding season (July) occurring at the tallest heights (Partin 1977).

Interspersion and Movements

Migrant brown thrashers arrive on the breeding range in southern and central Illinois in late February or early March (Graber et al. 1970). The fall migration back to winter range occurs during September and October. Brown thrashers wintering in southern Texas remain from September through March (Fischer 1981a). Breeding and wintering range overlap in southeastern States (Graber et al. 1970; American Ornithologists' Union 1983:571).

HABITAT SUITABILITY INDEX (HSI) MODEL

Model Applicability

Geographical area. This model was developed for the breeding range of the brown thrasher (Figure 1).

Season. This model is intended to evaluate breeding season (April-August) habitat requirements.

Cover types. This model can be used to evaluate habitat in Deciduous and Evergreen Forest (DF, EF), Tree Savannah (DTS, ETS), Shrubland (DS, ES), Shrub

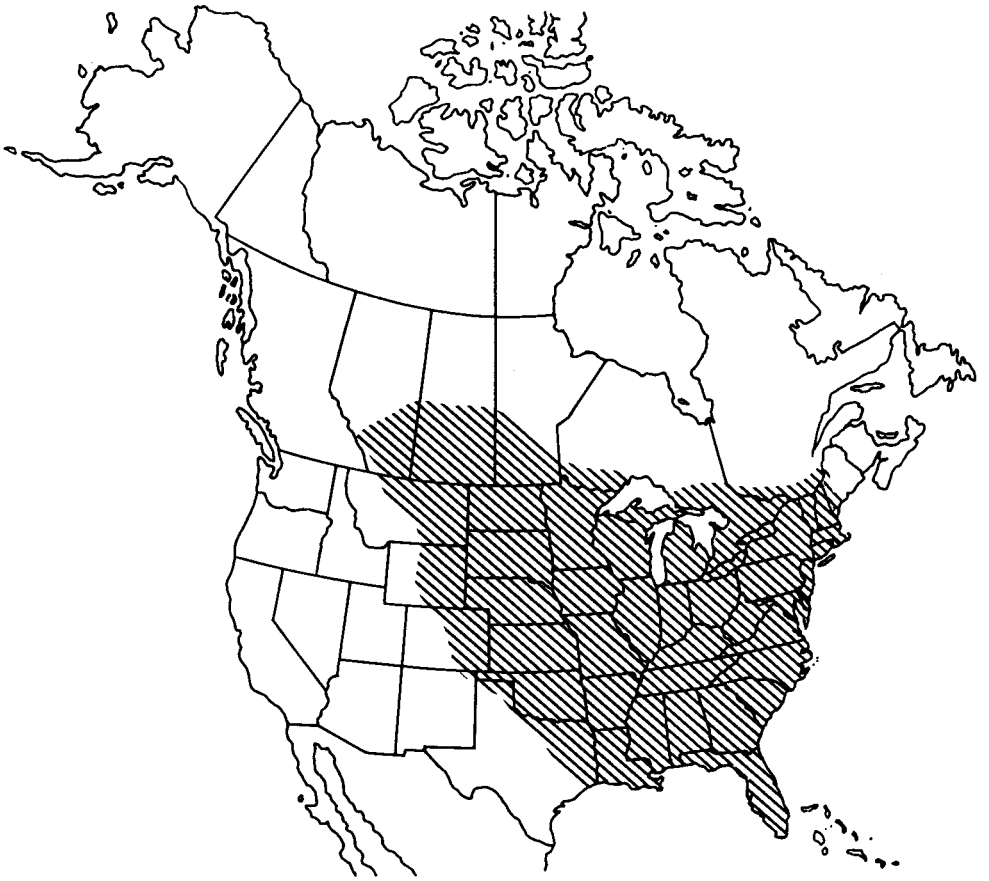

Figure 1. Breeding range of the brown thrasher (adapted from Graber et al. 1970).

Savannah (DSS, ESS), Grasslands (G), Forbland (F), Orchard (O), and Pasture and Hayland (P/H) cover types (terminology according to U.S. Fish and Wildlife Service 1981).

Minimum habitat area. Minimum habitat area is defined as the minimum amount of contiguous habitat that is required before an area will be occupied by a species. This information was not found for the brown thrasher. Although brown thrashers can occur at densities exceeding 1 male/ha on the breeding range (Graber et al. 1970), it is recommended that this model only be applied on areas ≥1.0 ha. Stauffer and Best (1980) recommended a minimum mean width of 40 m for woody riparian habitat to support brown thrashers.

Verification level. This model was reviewed by Dr. Dean F. Stauffer, Department of Fisheries and Wildlife Sciences, Virginia Polytechnic Institute and State University, Blacksburg, and Gregory A. Hiemenz, Zoology Department, North Dakota State University, Fargo. Their comments have been incorporated into the model and referenced as personal communications. This model has not been validated with field data.

Model Description

Overview. Brown thrashers occupy a wide range of cover types on the breeding range (Graber et al. 1970), with highest breeding densities occurring in shrub or midsuccessional stages of forests (Graber et al. 1970; Shugart and James 1973; Temple et al. 1979; Stauffer and Best 1980; Faanes 1983). The life requisites of food, cover, and reproduction addressed with this model are considered one component, modeled with the same variables.

Food/cover/reproduction component. Shrub and tree stems provide nesting sites (Graber et al. 1970; Partin 1977; Stauffer and Best 1980), territorial song perches (Graber et al. 1970; Kahl et al. 1985), and loafing cover (Fischer 1981b). Most nests are located in shrubs or trees >1.0 m tall (Graber et al. 1970; Partin 1977) in areas having an open tree canopy and a dense shrub understory (Gates and Gysel 1978; Stauffer, pers. comm.). Males sing from the tops of trees 4 to 18 m tall (Kahl et al. 1985) in areas having an open tree canopy and dense ground cover (James 1971).

Presence of a deep, nonacid humus on the forest floor is associated with abundance of invertebrates (Stenger 1958). Early successional deciduous trees and shrubs that have low carbon-nitrogen ratios in their leaves provide palatable leaf litter that supports large populations of invertebrates (Wallwork 1976), which brown thrashers feed on during the breeding season (Graber et al. 1970). Eighty-five to 90% cover of litter 1 to 2 cm deep was considered optimum for brown thrasher territories in Missouri (Kahl et al. 1985). Arthropod activity in leaf litter and, hence, availability to insectivores increases with increasing ambient humidity (Jaeger 1972). Relative humidity in a deciduous forest has been correlated ($r = 0.618$, $P < 0.01$) with foliage density, principally in vegetation layers <7.0 m in height (Petit et al. 1985). Arthopod biomass was positively correlated ($P < 0.01$) with percentage of ground cover ($r = 0.72$), foliage density at 1 m ($r = 0.64$) and ground level ($r = 0.57$), and total foliage density at 0 to 3 m ($r = 0.51$) in pine (Pinus spp.)-hardwood forests in east Texas (Conner et al. 1986). The relationship among arthropod availability, ambient humidity, and understory foliage density may explain the positive correlations ($r = 0.220$ to 0.358, $P < 0.05$) observed between foliage volume of deciduous tree and shrub layers ≤6.1 m in height and breeding densities of brown thrashers ($\bar{x} = 128.4$/100 ha) in suburban areas of Massachusetts (Thomas et al. 1977).

This model assumes shrub and forest stands that have 10,000 to 30,000 woody stems ≥1.0 m tall/ha (Figure 2a), 10% to 30% tree (≥5.0 m tall) canopy cover (Figure 2b), and ≥80% litter cover ≥1 cm deep (Figure 2c) provide optimal habitat for brown thrashers. Habitat suitability decreases when woody stem density decreases to <10,000 stems/ha or increases to >30,000 stems/ha, when canopy cover of trees decreases to <10% or increases to >30%, and when litter cover decreases to <80%. However, none of these characteristics is assumed to produce completely unsuitable habitat for brown thrashers (Heimenz, pers. comm.; Stauffer, pers. comm.).

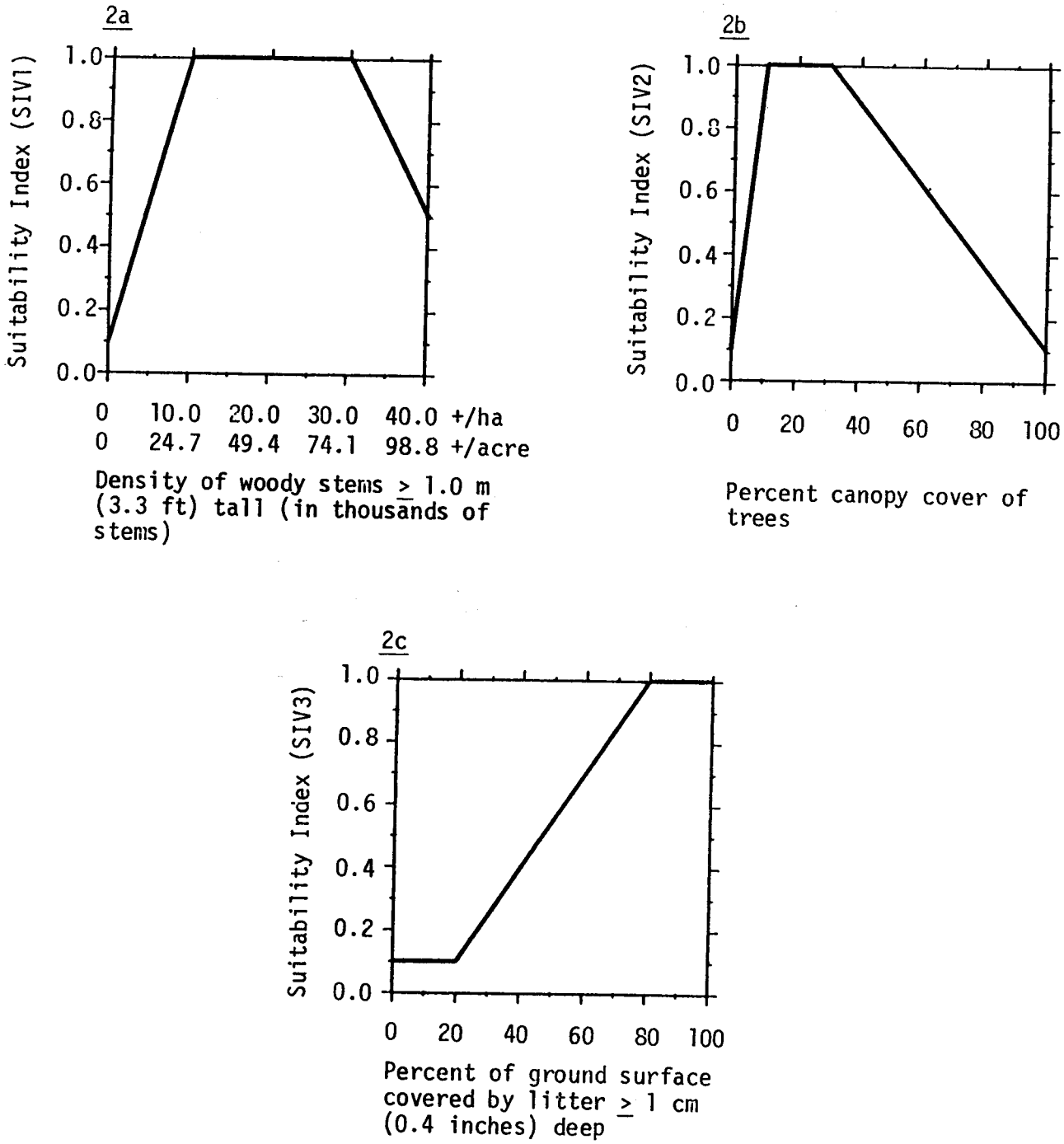

Figure 2. The relationship between suitability indices and variables used to evaluate breeding habitat for the brown thrasher.

Grasslands with 0% tree canopy coverage and no woody stems are assumed to have a maximum suitability of 0.01 provided that there is optimal litter cover (≥80%). Early successional shrublands with 0% tree canopy coverage and ≥40,000 woody stems/ha are assumed to have a maximum suitability of 0.05 provided that there is optimal litter cover. Mature closed canopy forests (100% canopy cover) are assumed to have a maximum suitability of 0.10 provided that there is optimal density of woody stems (10,000 to 30,000/ha) in the understory and optimal litter cover. The food/cover/reproduction index (SIFCR) for the brown thrasher is described by equation 1.

$$SIFCR = SIV1 \times SIV2 \times SIV3 \quad (1)$$

Because none of the variables are considered compensatory and each directly modifies the suitability of the others, suboptimal suitabilities for two or three variables yield a suitability for food/cover/reproduction that is lower than the lowest individual suitability index for the variables.

HSI determination. An HSI for any given cover type is equal to the food/cover/reproduction index in the cover type. Several steps and calculations are necessary to determine an area-wide HSI score for cover types used by brown thrashers:

1. Compute the HSI for each cover type by collecting field data for habitat variables, entering these data into the proper suitability curve, and using the resulting indices in the food/cover/reproduction component equation.

2. Determine a weighted HSI for each cover type by multiplying the area of each cover type by its corresponding HSI value (from 1 above).

3. The overall HSI for a study area is equal to the sum of the weighted HSI values (from 2 above) divided by the total area of all cover types potentially used by brown thrashers on the study area.

Application of the Model

Summary of model variables. Three habitat variables are used to evaluate habitat suitability for brown thrashers (Figure 3). Definitions of habitat variables and suggested field measurement techniques (Hays et al. 1981) are provided in Figure 4.

Model assumptions. The major assumptions in this model are:

1. Food and cover associated with reproduction are the limiting requisites for brown thrashers on the breeding range. Breeding habitat for brown thrashers must provide nesting cover, territorial song perches, and food.

2. Invertebrates are the limiting food source for brown thrashers on the breeding range.

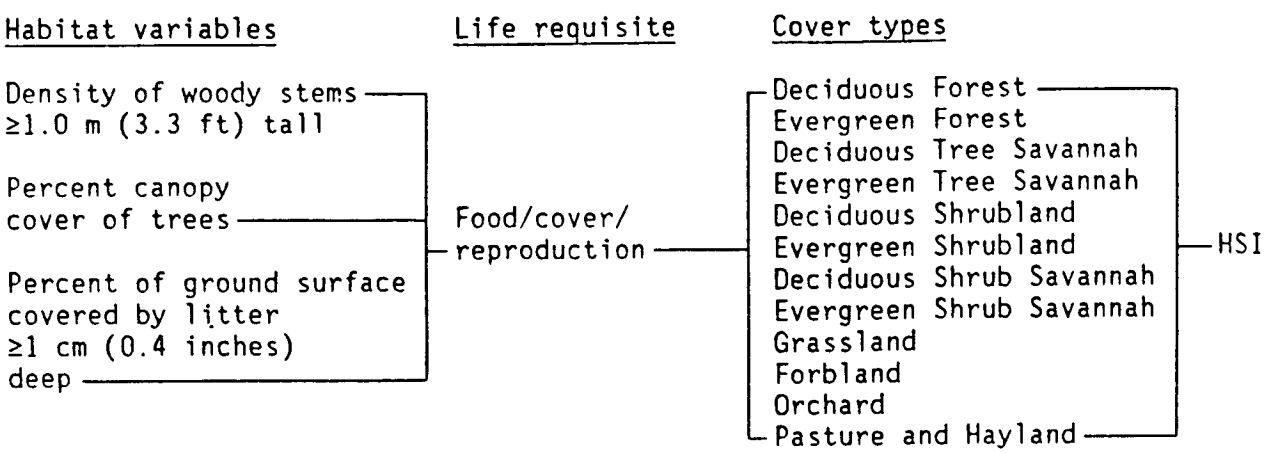

Figure 3. Relationship of habitat variables, life requisites, and cover types to the Habitat Suitability Index (HSI) for the brown thrasher.

Variable (definition)	Cover types	Suggested techniques
Density of woody stems ≥ 1.0 m (3.3 ft) tall [number of woody stems ≥1.0 m (3.3 feet) tall/ ha (2.47 acres)]	DF,EF,DTS,ETS, DS,ES,DSS,ESS, G,F,O,P/H	Quadrat count
Percent canopy cover of trees [the percent of the ground surface shaded by a vertical projection of the canopies of all woody vegetation ≥5.0 m (16.5 ft) tall].	DF,EF,DTS,ETS, DS,ES,DSS,ESS, G,F,O,P/H	Point intercept spherical densiometer
Percent of ground surface covered by litter ≥1 cm deep [percent of ground covered by herbaceous, shrub, and tree leaf litter ≥1 cm (0.4 inches) deep]	DF,EF,DTS,ETS, DS,ES,DSS,ESS, G,F,O,P/H	Point intercept pin frame

Figure 4. Definition of habitat variables and suggested measuring techniques.

3. Invertebrate abundance in the soil and litter is correlated with successional stage of the habitat and litter cover.

4. Foliage density in the understory can be measured using density of woody stems ≥1.0 m tall. Hiemenz (pers. comm.) notes, however, that the relationship between foliage density and stem density will vary among plant species, e.g., one buffaloberry (Shepherdia argentea) stem may produce as much foliage as 20 or more stems of western wild rose (Rosa woodsii). He suggests that a visual obstruction reading using a gridded cover board (e.g., Hays et al. 1981) might produce a better index of foliage density. This is a reasonable suggestion but, unfortunately, there are at present no data relating brown thrasher habitat use to visual obstruction readings.

SOURCES OF OTHER MODELS

No other habitat models for the brown thrasher were found in the literature.

REFERENCES

American Ornithologists' Union. 1983. Check-list of North American birds. 6th edition. Am. Ornithol. Union. [Washington, DC.] 877 pp.

Back, G. N. 1979. Avian communities and management guidelines of the aspen-birch forest. Pages 67-79 in R. M. DeGraff and K. E. Evans, compilers. Management of north central and northeastern forests for nongame birds. U.S. Dep. Agric. For. Serv. Gen. Tech. Rep. NC-51.

Berkey, G. B. 1983. Breeding bird censuses 120-123. Am. Birds 37(1):85-86.

Capen, D. E. 1979. Management of northeastern pine forests for nongame birds. Pages 90-109 in R. M. DeGraaf and K. E. Evans, compilers. Management of north central and northeastern forests for nongame birds. U.S. Dep. Agric. For. Serv. Gen. Tech. Rep. NC-51.

Cassel, J. F., and J. M. Wiehe. 1980. Uses of shelterbelts by birds. Pages 78-87 in R. M. DeGraaf, tech. coord. Management of western forests and grasslands for nongame birds. U.S. Dep. Agric. For. Serv. Gen. Tech. Rep. INT-86.

Conner, R. N., M. E. Anderson, and J. G. Dickson. 1986. Relationships among territory size, habitat, song, and nesting success of northern cardinals. Auk 103(1):23-31.

Dickson, J. G., and R. E. Noble. 1978. Vertical distribution of birds in a Louisiana bottomland hardwood forest. Wilson Bull. 90(1):19-30.

Emlen, J. T. 1972. Size and structure of a wintering avian community in southern Texas. Ecology 53(2):317-329.

Faanes, C. H. 1983. Breeding birds of wooded draws in western North Dakota. Prairie Nat. 15(4):173-187.

Facemire, C. F. 1978. Ground nesting Kansas thrashers. Kansas Ornithol. Soc. Bull. 29(3):21-22.

Fischer, D. H. 1979. Comparative ecology of the thrashers, Toxostoma, of south Texas. M.S. Thesis, Texas A&M University, College Station. 85 pp.

_____. 1981a. Wintering ecology of thrashers in southern Texas. Condor 83(4):340-346.

_____. 1981b. Winter time budgets of brown thrashers. J. Field Ornithol. 52(4):304-308.

Fleckenstein, J., and S. Mack. 1981. Breeding bird censuses 129-131, 134-136. Am. Birds 35(1):81-83.

Gates, J. E., and L. W. Gysel. 1978. Avian nest dispersion and fledging success in field-forest ecotones. Ecology 59(5):871-883.

Graber, R. R., J. W. Graber, and E. L. Kirk. 1970. Illinois birds: Mimidae. Illinois Nat. Hist. Surv. Biol. Notes 68:24-35.

Hays, R. L., C. Summers, and W. Seitz. 1981. Estimating wildlife habitat variables. U.S. Fish Wildl. Serv. FWS/OBS-81/47. 111 pp.

Heagy, P. A., and L. B. Best. 1983. Factors affecting feeding and brooding of brown thrasher nestlings. Wilson Bull. 95(2):297-303.

Hiemenz, G. 1981. Breeding bird census 127. Am. Birds 35(1):80.

Hiemenz, G., and F. Wallace. 1981. Breeding bird census 124. Am. Birds 35(1):79.

Hopkins, R., and M. D. Schwartz. 1981. Breeding bird censuses 125 and 132. Am. Birds 35(1):79-82.

Jaeger, R. G. 1972. Food as a limited resource in competition between two species of terrestrial salamanders. Ecology 53(3):535-546.

James, F. C. 1971. Ordinations of habitat relationships among breeding birds. Wilson Bull. 83(3):215-236.

Kahl, R. B., T. S. Baskett, J. A. Ellis, and J. N. Burroughs. 1985. Characteristics of summer habitats of selected nongame birds in Missouri. Univ. Missouri Agric. Exp. Sta. Res. Bull. 1056. 155 pp.

Kendeigh, S. C. 1948. Bird populations and biotic communities in northern lower Michigan. Ecology 29(1):101-114.

Meyers, J. M., and A. S. Johnson. 1978. Bird communities associated with succession and management of loblolly-shortleaf pine forests. Pages 50-65 in R. M. DeGraaf, tech. coord. Proc. workshop on management of southern forests for nongame birds. U.S. Dep. Agric. For. Serv. Gen. Tech. Rep. SE-14.

Niemi, G. J., and L. Pfannmuller. 1979. Avian communities: approaches to describing their habitat associations. Pages 154-178 in R. M. DeGraaf and K. E. Evans, compilers. Management of north central and northeastern forests for nongame birds. U.S. Dep. Agric. For. Serv. Gen. Tech. Rep. NC-51.

Partin, H. 1977. Breeding biology and behavior of the brown thrasher, (Toxostoma rufum). Ph.D. Dissertation, Ohio State University, Columbus. 139 pp.

Petit, D. R., K. E. Petit, and T. C. Grubb, Jr. 1985. On atmospheric moisture as a factor influencing distribution of breeding birds in a temperate deciduous forest. Wilson Bull. 97(1):88-96.

Shalaway, S. D. 1985. Fencerow management for nesting birds in Michigan. Wildl. Soc. Bull. 13(3):302-306.

Shugart, H. H., and D. James. 1973. Ecological succession of breeding bird populations in northwestern Arkansas. Auk 90(1):62-77.

Stauffer, D. F., and L. B. Best. 1980. Habitat selection by birds of riparian communities: evaluating effects of habitat alterations. J. Wildl. Manage. 44(1):1-15.

Stenger, J. 1958. Food habits and available food of ovenbirds in relation to territory size. Auk 75(3):335-346.

Temple, S. A., M. J. Mossman, and B. Ambuel. 1979. The ecology and management of avian communities in mixed hardwood-coniferous forests. Pages 132-153 in R. M. DeGraaf and K. E. Evans, compilers. Management of north central and northeastern forests for nongame birds. U.S. Dep. Agric. For. Serv. Gen. Tech. Rep. NC-51.

Thomas, J. W., R. M. DeGraaf, and J. C. Mawson. 1977. Determination of habitat requirements for birds in suburban areas. U.S. Dep. Agric. For. Serv. Res. Pap. NE-357. 15 pp.

U.S. Fish and Wildlife Service. 1981. Standards for the development of Habitat Suitability Index models. 103 ESM. U.S. Fish Wildl. Serv., Div. Ecol. Serv., Washington, D.C. n.p.

Wallwork, J. A. 1976. The distribution and diversity of soil fauna. Academic Press, New York. 355 pp.

Willson, M. F. 1974. Avian community organization and habitat structure. Ecology 55(5):1017-1029.

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A review and synthesis of existing information were used to develop a Habitat Suitability Index (HSI) model for the brown thrasher (Toxostoma rufum). The model consolidates habitat use information into a framework appropriate for field application, and is scaled to produce an index between 0.0 (unsuitable habitat) and 1.0 (optimum habitat). HSI models are designed to be used with Habitat Evaluation Procedures previously developed by the U.S. Fish and Wildlife Service.

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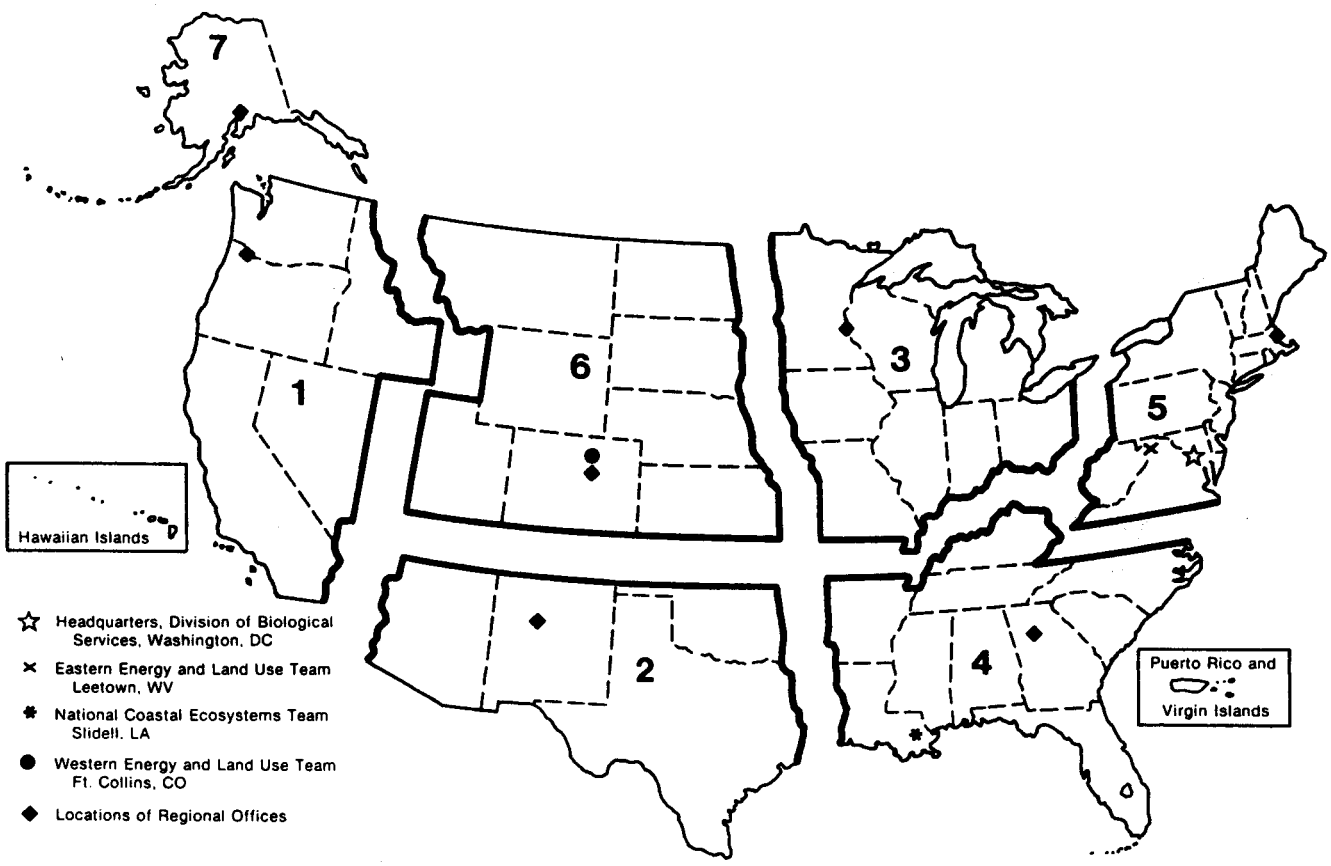

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